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Poultry experiments

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WEST VIRGINIA UNIVERSITY
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POULTRY EXPERIMENTS

Mash compared with Whole Grain, and Heavy Feeding compared with Light Feeding as Affecting the Number of Eggs Laid and their Hatchability.

Beef Scrap, Ground Fresh Meat and Bone, and Milk Albumen as Affecting the Hatchability of Eggs.

The Color of the Yolks of Eggs Influenced by Different Foods.

By J. H. STEWART and HORACE ATWOOD.

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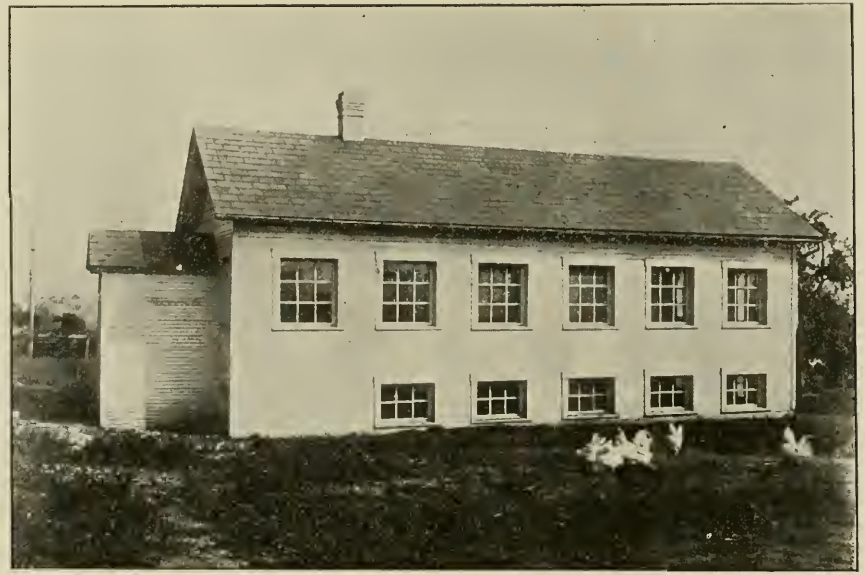

INCUBATOR CELLAR AND NURSERY.

MASH COMPARED WITH WHOLE GRAIN, AND HEAVY FEEDING COMPARED WITH LIGHT FEEDING AS AFFECTING THE NUMBER OF EGGS AND THEIR HATCHABILITY.

Previous experiments have shown that with White Leghorn fowls, more eggs are produced when about one-third of the grain ration is fed ground and moistened, than when all of the grain is fed whole and scattered in the litter. The experiments described below were performed in order to study the effect upon egg production and the hatchability of the eggs of feeding a ration in which all of the grain is fed ground and moistened ; also the effect of heavy and light feeding.

Mash Fed Continually.

This experiment was begun December 1st, 1902, with three pens of single comb White Leghorns, and was continued for two periods of one hundred and twenty days each. Each pen contained twenty pullets and two cockerels. The fowls were kept in the houses and runs described in bulletin 71, and the general method of conducting the experiment was the same as has been described in former bulletins.

Pen one received no whole grain from the beginning until the close of the experiment. The ground feed consisted of equal parts of corn meal, ground wheat, and ground oats. Beef scrap was usually added to the morning meal and the whole moistened with water at the ordinary temperature. The fowls were fed twice each day as much as they would eat up clean in about one half hour. Pen two was fed a grain ration consisting of equal parts of corn, wheat, and oats, one-third of which was ground

and fed similarly to the ground feed fed to pen one. The whole grain was scattered in the litter, and the beef scrap was incorporated in the mash. Pen three received corn, wheat, and oats, scattered in litter. The beef scrap was fed dry. Pens two and three were fed nearly as possible the same amount of grain and beef scrap as was fed to pen one.

The following table shows the average weight of the pullets and cockerels at the beginning and at the end of the experiment:

	Pen 1.		Pen 2.		Pen 3.	
	Hens.	Cocks.	Hens.	Cocks.	Hens.	Cocks.
Aver. weight at beg'ng	2.85	4.00	3.05	4.00	3.05	4.50
Average weight at end	3.22	4.75	3.25	4.50	3.20	4.75

Both hens and cocks increased slightly in weight during the test.

The amount of food consumed and the number of eggs laid by each pen of fowls is shown below:

PERIOD 1, 120 DAYS.

	Corn.	Whe't	Oats.	Corn Meal.	Grn'd Wheat	Grn'd Oats.	Beef Scrap.	Eggs Laid.
Pen 1	.....	.....	.....	165	165	165	40	709
Pen 2	110	110	110	55	55	55	40	666
Pen 3	165	165	165	.....	.... ..	.....	40	696

PERIOD 2, 120 DAYS.

	Corn.	Wheat	Oats.	Corn Meal.	Gr'nd Wheat	Gr'nd Oats.	Beef Scrap.	Eggs Laid.
Pen 1	.....	.....	.....	188	168	168	24	1108
Pen 2	127	114	114	65	58	58	23	1138
Pen 3	193	173	173	.....	.....	.....	24	961

The total number of eggs produced by Pen 1, during the 240 days of the experiment was 1817. Pen 2 produced 1804, and pen 3 laid 1657. It is thus seen that with practically the same amounts of food consumed the pen of fowls fed entirely upon

mash led in egg production, very closely followed by the pen receiving one-third of the ration ground feed, while a considerable distance in the rear is the pen which received whole grain.

At no time during the experiment was the egg production heavy. At the beginning of the test several of the pullets of each lot were immature and did not begin laying until spring, and then the fowls were not fed heavily, as the eggs were incubated and it was not considered desirable to have the hens too fat.

The Hatchability of The Eggs.

The eggs were hatched in Cyphers and Star incubators. In order to make the conditions during the hatch uniform for all of the eggs the trays were changed from end to end in the morning, and from side to side at night. Also the relative position of the eggs upon the trays was changed twice each day when the eggs were turned. The eggs were tested at the end of the twelfth day, and those which were rejected were classed as unfertile.

The following tables show the number of eggs incubated from the three lots of fowls, the percentage of the eggs which were fertile, the percentage of the fertile eggs which hatched, and the percentage which hatched of the total number of eggs incubated :

Hatch 1, Cyphers Incubator.
Started February 16th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	39	24	32
Percentage of the eggs which were fertile	94. 8	95. 8	87. 5
Percentage of the fertile eggs which hatched	91. 8	95. 6	92. 8
Percentage which hatched of all eggs incubated	87. 1	91. 6	81. 2

Hatch 2, Cyphers Incubator.
Started March 3rd, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	40	51	64
Percentage of the eggs which were fertile	92. 5	86. 2	90. 6
Percentage of the fertile eggs which hatched	81. 0	61. 3	91. 3
Percentage which hatched of all eggs incubated	75. 0	52. 9	82. 8

Hatch 3, Star Incubator.
Started March 10th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	23	18	35

Percentage of the eggs which were fertile.....	100	94.4	88.5
Percentage of the fertile eggs which hatched...	95.6	94.1	93.5
Percentage which hatched of all eggs incubated	95.6	88.8	82.8

HATCH 4, CYPHERS INCUBATOR.

Started March 12th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	38	29	21
Percentage of the eggs which were fertile.....	92.1	89.6	95.2
Percentage of the fertile eggs which hatched ...	100	88.4	95
Percentage which hatched of all eggs incubated	92.1	79.3	90.4

HATCH 5, CYPHERS INCUBATOR.

Started March 25th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	88	76	62
Percentage of the eggs which were fertile.....	88.6	86.8	87.0
Percentage of the fertile eggs which hatched....	96.1	96.9	88.8
Percentage which hatched of all eggs incubated	85.2	84.2	77.4

HATCH 6, CYPHERS INCUBATOR.

Started April 3rd, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	31	61	38
Percentage of the eggs which were fertile.....	100	81.9	94.7
Percentage of the fertile eggs which hatched-...	90.3	84	88.8
Percentage which hatched of all eggs incubated	90.3	68.8	84.2

HATCH 7. STAR INCUBATOR.

Started April 8th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	24	24	24
Percentage of the eggs which were fertile.....	87.5	95.8	87.5
Percentage of the fertile eggs which hatched....	100	91.3	95.2
Percentage which hatched of all eggs incubated	87.5	87.5	83.3

HATCH 8. CYPHERS INCUBATOR.

Started April 17th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	54	51	45
Percentage of the eggs which were fertile.....	98.1	96.0	82.2
Percentage of the fertile eggs which hatched....	92.4	91.8	86.4
Percentage which hatched of all eggs incubated	90.7	88.2	71.1

HATCH 9. CYPHERS INCUBATOR.

Started April 25th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	52	44	46
Percentage of the eggs which were fertile	96. 1	88. 6	95. 6
Percentage of the fertile eggs which hatched	96. 0	84. 6	93. 1
Percentage which hatched of all eggs incubated	92. 3	75	89. 1

HATCH 10. STAR INCUBATOR.

Started May 3rd, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	37	36	54
Percentage of the eggs which were fertile	91. 8	91. 5	85. 1
Percentage of the fertile eggs which hatched	82. 3	87. 8	93. 4
Percentage which hatched of all eggs incubated	75. 6	80. 5	79. 6

HATCH 11. CYPHERS INCUBATOR.

Started May 9th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	37	31	45
Percentage of the eggs which were fertile	94. 5	93. 5	91. 1
Percentage of the fertile eggs which hatched	97. 1	100	90. 2
Percentage which hatched of all eggs incubated	91. 8	93. 5	82. 2

HATCH 12. CYPHERS INCUBATOR.

Started May 18th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	73	68	46
Percentage of the eggs which were fertile	91. 7	88. 2	89. 1
Percentage of the fertile eggs which hatched	89. 5	88. 3	95. 1
Percentage which hatched of all eggs incubated	82. 1	77. 9	84. 7

HATCH 13. STAR INCUBATOR.

Started May 28th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	46	36	27
Percentage of the eggs which were fertile	91. 3	83. 3	88. 8
Percentage of the fertile eggs which hatched	85. 7	90. 0	91. 6
Percentage which hatched of all eggs incubated	78. 2	75. 0	81. 4

HATCH 14. CYPHERS INCUBATOR.

Started June 7th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	35	38	25

Percentage of eggs which were fertile.....	97. 1	94. 7	88. o
Percentage of the fertile eggs which hatched....	97	91. 6	95. 4
Percentage which hatched of all eggs incubated	94. 2	86. 8	84. o

HATCH 15. CYPHERS INCUBATOR.

Started June 26th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	15	48	35
Percentage of the eggs which were fertile.....	93. 3	85. 4	91. 4
Percentage of the fertile eggs which hatched....	85. 7	90. 2	93. 7
Percentage which hatched of all eggs incubated	80. o	77. o	85. 7

The following table summarizes the results obtained :

	Pen 1.	Pen 2.	Pen 3.
Total number of eggs incubated.....	632	635	599
Percentage of the eggs which were fertile	93. 5	88. 8	89. 3
Percentage of the fertile eggs which hatched....	92. 2	88. 8	91. 9
Percentage which hatched of all eggs incubated	86. 2	78. 8	82. 1

The eggs laid by pen 1 hatched slightly better than those from either of the other pens. If this result were due to the fact that these fowls were fed entirely upon mash, then the eggs from pen 2 should have hatched somewhat better than those from pen 3. This is not the case when a general average of all the hatches is considered, but when the fifteen individual hatches are reviewed it is seen that the eggs from pen 2 hatched better than those from pen 3 in eight instances. Possibly some factor such as the inherent vigor of the cocks interfered so as to reduce slightly the vitality of the germs in the eggs produced by pen 2.

The true explanation of the results of this test probably does not lie in the fact that pen 1 was fed upon mash, but rather in the fact that pen 1 was fed relatively, although not absolutely heavier than either pen 2 or 3, as the fowls in these latter pens not only were obliged to grind the whole grain which they received, but they were also obliged to take a considerable amount of exercise in obtaining the grain which was scattered in the litter.

Elsewhere in this bulletin it is shown that when fowls are fed so scantily as to restrict slightly the egg production, then the fertility of the eggs is also diminished.

The fact remains, however, that with young White Leghorn fowls, a large proportion, if not all, of the ration can be com-

posed of ground food without diminishing either the egg production, decreasing the hatchability of the eggs, or injuring the health of the fowls. With the heavier and more sluggish breeds this might not hold true.

Whether chicks from mash fed fowls are as hearty and vigorous as those from fowls which are obliged to take much more exercise is a matter which remains for future study.

HEAVY FEEDING COMPARED WITH LIGHT FEEDING AS AFFECTING THE NUMBER OF EGGS LAID AND THEIR HATCHABILITY.

Should hens be fed heavily, when the eggs which are produced are to be incubated, or should the amount of food be somewhat restricted so as to induce the hens to take as much exercise as possible?

The following experiments have been performed in order to study this question:

TEST 1.

This experiment was begun November 1, 1901, with two lots of Rhode Island Red fowls. Each flock consisted of twelve pullets, eight two-year-old hens and two cocks. Until the first of December both lots of fowls were fed the same amount of food, and laid practically the same number of eggs. During the remainder of the test the fowls in pen 1 were fed practically all the food they would consume, while those in pen 2 were fed less liberally so as to restrict the egg production. The experiment was divided into two periods of four months each. Hatching was begun December 10th, and was continued at intervals until June 18th.

The following table gives the weight of the fowls at the beginning of the first and second periods and at the end of the test:

	Pen 1.		Pen 2.	
	Hens.	Cocks.	Hens.	Cocks.
Average weight at the beginning of the first period	5.02	5.60	5.00	6.25
Average weight at the beginning of the second period	5.40	7.50	5.05	6.00
Average weight at the end of the test	5.40	7.00	4.87	5.50

The following table shows the total amount of food consumed by each lot of fowls during the test. As the table shows, the fowls were fed principally upon corn, wheat, and oats. The whole grain was scattered in the litter. Pen 1 was fed so liberally that there was a constant supply of grain in the litter, and as there were some mice which it was impossible to get rid of, it is probable that those fowls did not consume all the food shown by the table.

Table showing the number of pounds of food supplied to pens 1 and 2 during eight months :

	Corn Meal.	Wheat Bran.	Gr'nd Oats.	Beef Scrap.	Corn.	Wheat	Oats.	Total.
Pen 1	34	34	34	60. 5	254.	370.	270.	1056. 5
Pen 2	30. 3	30. 3	30. 3	49	177.	291. 5	249.	857. 4

The table shows that pen 1 received nearly one-fourth more food than pen 2.

The number or eggs laid from the time when incubation was begun until the close of the experiment is shown below :

	Pen 1.	Pen 2.
December 12th to 30th	27	16
January	124	50
February	189	115
March	234	156
April	232	211
May	181	217
June	152	165

The table shows that pen 1 led in egg production until May, when pen 2 took the lead.

The following tables show the details of the different hatches. The eggs were hatched in a Cyphers incubator. The incubator was operated, during this test, in a room which was very unsatisfactory, as the temperature during the winter frequently fell below freezing, and during the later hatches in the spring the room was as much too warm during the day-time as it was too cold in winter. The eggs from both lots of fowls were subjected, however, to the same unfavorable conditions, so the results obtained, nevertheless, are comparable.

HATCH 1.

Started December 10th, 1901.

	Pen 1.	Pen 2.
Number of eggs incubated	24	36
Percentage of the eggs which were fertile	66.6	72.2
Percentage of the fertile eggs which hatched	62.5	46.1
Percentage which hatched of all eggs incubated	41.7	33.3

HATCH 2.

Started January 7th, 1902.

	Pen 1.	Pen 2.
Number of eggs incubated	53	14
Percentage of the eggs which were fertile	88.7	92.8
Percentage of the fertile eggs which hatched	82.9	76.9
Percentage which hatched of all eggs incubated	73.6	71.4

HATCH 3.

Started February 4th, 1902.

	Pen 1.	Pen 2.
Number of eggs incubated	72	34
Percentage of the eggs which were fertile	90.2	76.4
Percentage of the fertile eggs which hatched	67.7	57.7
Percentage which hatched of all eggs incubated	61.1	44.1

HATCH 4.

Started February 27th, 1902.

	Pen 1.	Pen 2.
Number of eggs incubated	33	31
Percentage of the eggs which were fertile	75.7	67.7
Percentage of the fertile eggs which hatched	72.0	61.9
Percentage which hatched of all eggs incubated	54.5	41.9

HATCH 5.

Started March 21st, 1902.

	Pen 1.	Pen 2.
Number of eggs incubated	63	33
Percentage of the eggs which were fertile	92.0	93.9
Percentage of the fertile eggs which hatched	84.4	67.7
Percentage which hatched of all eggs incubated	77.7	63.6

HATCH 6.

Started April 12th, 1902.

	Pen 1.	Pen 2.
Number of eggs incubated	33	50
Percentage of the eggs which were fertile	87.9	86.0
Percentage of the fertile eggs which hatched	79.3	58.1
Percentage which hatched of all eggs incubated	66.7	50.0

HATCH 7.

Started May 5th, 1902.

	Pen 1.	Pen 2.
Number of eggs incubated	19	17
Percentage of the eggs which were fertile	84.2	82.3
Percentage of the fertile eggs which hatched	93.7	85.7
Percentage which hatched of all eggs incubated	78.9	70.6

HATCH 8.

Started May 26th, 1902.

	Pen 1.	Pen 2.
Number of eggs incubated	33	47
Percentage of the eggs which were fertile	87.8	89.3
Percentage of the fertile eggs which hatched	79.3	88.1
Percentage which hatched of all eggs incubated	69.6	78.7

HATCH 9.

Started June 18th, 1903

	Pen 1.	Pen 2.
Number of eggs incubated	20	14
Percentage of the eggs which were fertile	75.0	64.3
Percentage of the fertile eggs which hatched	86.6	88.8
Percentage which hatched of all eggs incubated	65.0	57.1

The following tables summarizes the results obtained :

	Pen 1.	Pen 2.
Total number of eggs incubated	350	276
Percentage of the eggs which were fertile	85.7	81.5
Percentage of the fertile eggs which hatched	78.0	68.4
Percentage which hatched of all eggs incubated	66.8	55.9

Reviewing the individual hatches it is seen that there is only one instance in which the eggs from pen 2 hatched better than those from pen 1. Taking the average of all the hatches, 66.8 per cent. of all the eggs incubated from pen 1 hatched, while only 55.9 per cent. of the eggs hatched from pen 2.

TEST 2.

This experiment was begun January 15th, 1903, with two similar pens of White Leghorns, and was continued until July 1st. Each pen contained twenty pullets and two cockerels. Both lots of fowls were fed principally upon corn, wheat, and oats, scattered in litter about six inches deep. Pen 1 was fed so that some grain remained in the litter from feed to feed, while the other

lot of fowls was always anxious for a little more. Beef scrap was fed in troughs, and the same amount was supplied to each pen.

The following table shows the average weight of the fowls at the beginning of the test, April 1st, and at the close of the experiment:

	Pen 1.		Pen 2.	
	Hens.	Cocks.	Hens.	Cocks.
January 15th	3. 27	4. 50	3. 42	5.
April 1st	3. 32	5. 00	3. 17	5.
July 1st	3. 72	5. 00	3. 60	5. 20

The total amount of food supplied during the five and one-half months test is shown below:

	Beef Scrap.	Gr'nd Oats	Whe't	Oats.	Corn.	Total.
Pen 1	50	10	258	358	278	954
Pen 2	51	10	186	256	206	709

Pen 1 was fed about one-third more than pen 2.

The following table shows the number of eggs laid:

	Pen 1.	Pen 2.
January 15th to 30th	53	33
February	169	60
March	369	206
April	304	261
May	244	241
June	219	227
Total	1358	1028

The table shows that pen 1 led in egg production until the month of June, when pen 2 took the lead. It is also to be observed that the total egg production during the test is almost directly proportional to the amount of food supplied.

The following table give the results of the different hatches. For purposes of comparison the results obtained in hatching eggs

from fowls having free range are also included. These fowls, referred to as pen 3 in the tables, were principally White Leghorn hens two years old. They had the run of the barn-yard, and were fed about the same as the ordinary flock They received principally corn, wheat, oats, and beef scraps were fed occasionally, but no definite records were kept of either the kind or the amount of food consumed

HATCH 1. CYPHERS INCUBATOR.

Started February 16th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	31	17	97
Percentage of the eggs which were fertile	96.7	82.3	92.7
Percentage of the fertile eggs which hatched	86.6	85.7	78.8
Percentage which hatched of all eggs incubated	83.8	70.5	73.1

HATCH 2. CYPHERS INCUBATOR.

Started March 3rd, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	55	9	19
Percentage of the eggs which were fertile	98.1	77.7	94.7
Percentage of the fertile eggs which hatched	85.1	100	83.3
Percentage which hatched of all eggs incubated	83.6	77.7	78.9

HATCH 3. STAR INCUBATOR.

Started March 10th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	52	24	45
Percentage of the eggs which were fertile	94.2	29.1	93.3
Percentage of the fertile eggs which hatched	75.5	57.1	83.3
Percentage which hatched of all eggs incubated	71.1	16.6	77.7

HATCH 4. CYPHERS INCUBATOR.

Started March 12th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated	36	24	114
Percentage of the eggs which were fertile	94 4	45.8	89.3
Percentage of the fertile eggs which hatched	97.0	90.9	93.1
Percentage which hatched of all eggs incubated	91.6	41.6	83.3

HATCH 5. CYPHERS INCUBATOR.

Started March 25th, 1903.

	Pen 1.	Pen 2.
Number of eggs incubated	49	45
Percentage of the eggs which were fertile	93.7	95.5

Percentage of the fertile eggs hatched.....	91. 3	95. 3
Percentage which hatched of all eggs incubated	85. 7	91. 1

HATCH 6. CYPHERS INCUBATOR.

Started April 3rd, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	60	22	131
Percentage of the eggs which were fertile.....	93. 3	90. 9	83. 9
Percentage of the fertile eggs which hatched...	91. 0	90	81. 8
Percentage which hatched of all eggs incubated	85	81. 8	68. 7

HATCH 7. STAR INCUBATOR.

Started April 8th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	24	24	110
Percentage of the eggs which were fertile	83. 3	87. 5	85. 4
Percentage of the fertile eggs which hatched....	100	85. 7	73. 4
Percentage which hatched of all eggs incubated	83. 3	75	62. 7

HATCH 8. CYPHERS INCUBATOR.

Started April 17th, 1903.

	Pen 1.	Pen 4.	Pen 3.
Number of eggs incubated.....	25	52	85
Percentage of the eggs which were fertile.....	92	90. 3	81. 1
Percentage of the fertile eggs which hatched...	86. 9	87. 2	82. 6
Percentage which hatched of all eggs incubated	80	78. 8	67. 0

HATCH 9. CYPHERS INCUBATOR.

Started April 25th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	39	45	79
Percentage of the eggs which were fertile.....	89. 7	93. 3	79. 7
Percentage of the fertile eggs which hatched....	82. 8	78. 5	80. 9
Percentage which hatched of all eggs incubated	74. 3	73. 3	64. 5

HATCH 10. STAR INCUBATOR.

Started May 3rd, 1903.

	Pen 1.	Pen 2.
Number of eggs incubated.	54	26
Percentage of the eggs which were fertile.....	88. 8	84. 6
Percentage of the fertile eggs which hatched...	87. 5	95. 4
Percentage which hatched of all eggs incubated	77. 7	80. 7

HATCH 11, CYPHERS INCUBATOR.

Started May 9th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	45	34	78

Percentage of the eggs which were fertile.....	93. 3	82. 3	88. 4
Percentage of the fertile eggs which hatched...	85. 7	96. 4	92. 7
Percentage which hatched of all eggs incubated	80	79. 4	82

HATCH 12. CYPHERS INCUBATOR.

Started May 18th, 1903.

	Pen 1.	Pen 3.	Pen 3.
Number of eggs incubated.....	72	61	51
Percentage of the eggs which were fertile	86. 1	86. 8	90. 1
Percentage of the fertile eggs which hatched...	98. 3	84. 9	86. 9
Percentage which hatched of all eggs incubated	84. 7	73. 7	78. 4

HATCH 13. STAR INCUBATOR.

Started May 28th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	21	28	87
Percentage of the eggs which were fertile.....	80. 9	75	82. 7
Percentage of the fertile eggs which hatched.....	94. 1	85. 7	80. 5
Percentage which hatched of all eggs incubated	76. 1	64. 2	66. 6

HATCH 14. CYPHERS INCUBATOR.

Started June 7th, 1903.

	Pen 1.	Pen 2	Pen 3.
Number of eggs incubated.....	21	28	122.
Percentage of the eggs which were fertile.....	95. 2	100	81. 9
Percentage of the fertile eggs which hatched.....	100	89. 2	92
Percentage which hatched of all eggs incubated	95. 2	89. 2	75. 4

HATCH 15. CYPHERS INCUBATOR.

Started June 26th, 1903.

	Pen 1.	Pen 2.	Pen 3.
Number of eggs incubated.....	56	33	19
Percentage of the eggs which were fertile.....	91	81. 8	94. 7
Percentage of the fertile eggs which hatched...	94. 1	88. 8	94. 4
Percentage which hatched of all eggs incubated	85. 7	72. 7	89. 4

The following table summarizes the results obtained:

	Pen 1.	Pen 2.	Pen 3.
Total number of eggs incubated.....	640	472	1037
Percentage of the eggs which were fertile.....	91. 7	82. 8	86. 1
Percentage of the fertile eggs which hatched.....	89. 7	87. 9	84. 4
Percentage which hatched of all eggs incubated	82. 3	72. 8	72. 7

Considering the fifteen hatches it is seen that the eggs from the fowls fed liberally hatched better than those from the fowls fed scantily in thirteen instances. The eggs from the

fowls running at large hatched about the same as those from the fowls fed scantily.

The results of these two tests should be construed as indicating that when the conditions are favorable for normal egg production, then the eggs will hatch better than when the conditions are unfavorable. On the other hand it is quite probable, and substantiated by experience, that breeds that are less active than the Leghorn when supplied too liberally with food become so fat that neither do the eggs hatch well nor are the chicks strong and vigorous.

BEEF SCRAP, GROUND FRESH MEAT AND BONE, AND MILK ALBUMEN AS AFFECTING THE HATCHABILITY OF EGGS.

During the winter of 1901 and 1902 a comparison was made of beef scrap, ground fresh meat and bone, and milk albumen as sources of protein for laying hens. This experiment has been described in Bulletin 83 to which reference is made for further details.

Eggs from those fowls were hatched in a Cyphers incubator. Very few of the hatches were satisfactory on account of the wide variation in temperature of the room in which the incubator was located, but as this would affect all the eggs in a similar manner the comparative result remain the same

Hatching was begun December 10th, 1901, and was continued at intervals until June 19, 1902.

The following table is a summary of the results obtained. Pens 1, 2 and 3 refer, respectively, to the fowls while receiving beef scrap, milk albumen, and ground fresh meat and bone.

	Pen 1.	Pen 2.	Pen 3.
Total number of eggs incubated	402	362	371
Percentage of the eggs which were fertile	86. 3	84. 5	85. 7
Percentage of the fertile eggs which hatched	80. 1	86. 2	81. 7
Percentage which hatched of all eggs incubated	69. 1	72. 9	70. 1

The table shows that there was no material difference in the

hatchability of the eggs resulting from the use of the three different feeding stuffs.

THE COLOR OF THE YOLKS OF EGGS INFLUENCED BY DIFFERENT FOODS.

During the winter of 1902 and 1903 a number of experiments were conducted to study the effect upon the flavor of eggs of feeding different foods and flavoring materials. It is quite unnecessary to say that if eggs could be produced having a more agreeable flavor than ordinary eggs they could be sold to special customers at a considerable advance over the usual market rates.

The grains fed either alone or in combination for this purpose include corn, wheat, oats, Canada field peas, cow peas, soy beans, peanuts and sunflower seed. The flavoring materials employed were trimethylamine, celery oil and oil of sassafras. Beef scrap was fed to balance the different rations except in one case when smoked herrings were used. The green food supplied consisted of sugar beets, which were readily eaten.

Quite contrary to expectations the flavor of the eggs was not noticeably altered by any of the rations or flavoring materials employed, although it has been shown by investigations at the North Carolina Station that the feeding of onions imparts a very distinct and undesirable flavor.

The different rations, however, very clearly affected the color of the yolks. When the grain ration consisted of wheat, oats, or white corn, fed either alone or in combination with each other the yolks were so light colored that the eggs would be quite unsuitable for fancy trade. When the grain supply consisted entirely of white corn the yolks were very light colored, while on the other hand, the feeding of yellow corn imparted to the yolks that rich yellow color which is so desirable.